

**Question 5** (7 marks)

(a) Use mathematical induction to prove that for any positive integer  $n$

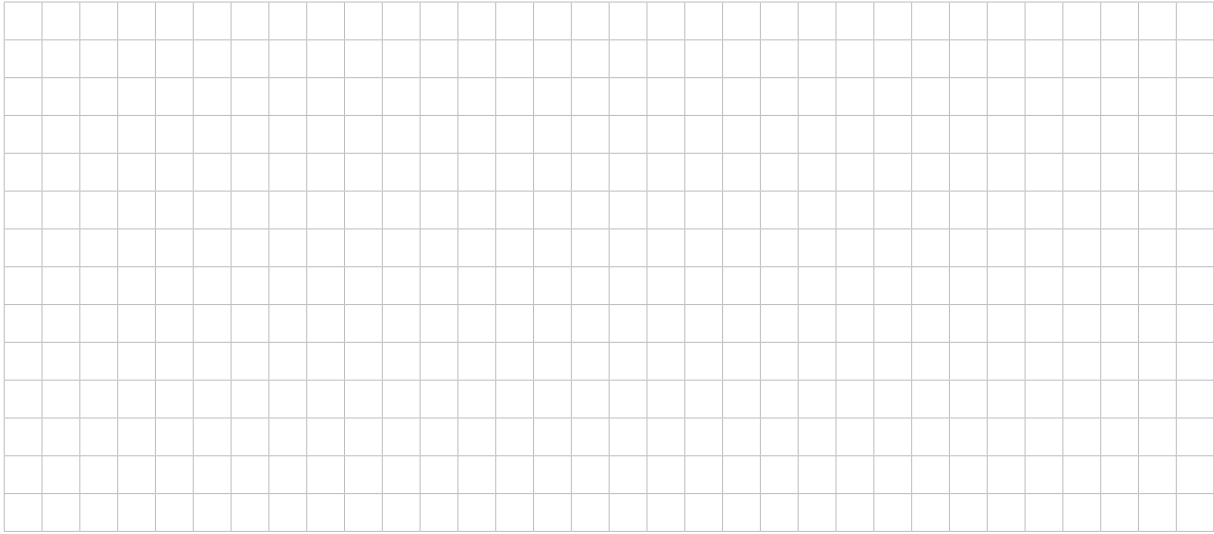
$$1 + \frac{1}{x} + \frac{1}{x^2} + \dots + \frac{1}{x^n} = \frac{x^{n+1} - 1}{x^n(x-1)}, \quad \text{if } x \neq 0, x \neq 1.$$



(5 marks)

(b) Hence show that, for any positive integer  $n$ :

$$1 + \frac{1}{11} + \frac{1}{11^2} + \dots + \frac{1}{11^n} < 1.1.$$



(2 marks)